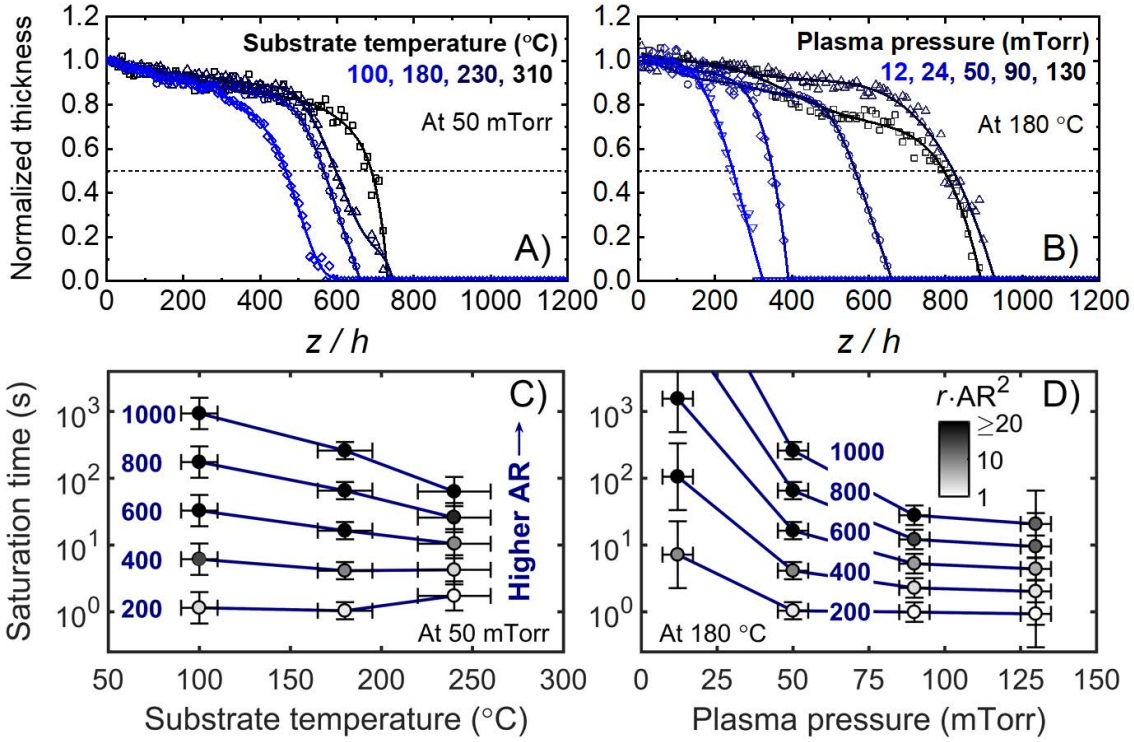
SUPPLEMENTARY INFORMATION

What controls the conformality of plasma ALD in high-aspect-ratio applications?

Karsten Arts, Sanne Deijkers, Tahsin Faraz, Riikka L. Puurunen, Erwin Kessels and Harm Knoops

Impact of radical recombination: Achieved film penetration into high-AR structures (A and B) and consequences for the saturation time (C and D)



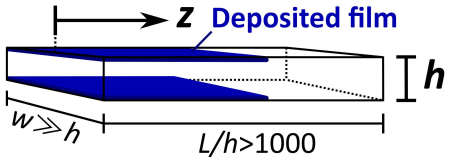


Figure S1: Normalized thickness profiles (A and B) of SiO_2 films grown by plasma ALD into high-aspect-ratio (AR) trench structures. Film growth is achieved up to extremely high AR values of $z/h \approx 200$ to 800, depending on temperature (A) and pressure (B), which is directly related to the surface recombination probability r of the plasma radicals. The dependence of r on temperature and pressure has a strong impact on the plasma time needed to reach saturation (C and D) on a high-AR structure.

Impact of ion bombardment: Influence on the growth per cycle (A and C), material properties (B) and film conformality on 3D nanostructures (D)

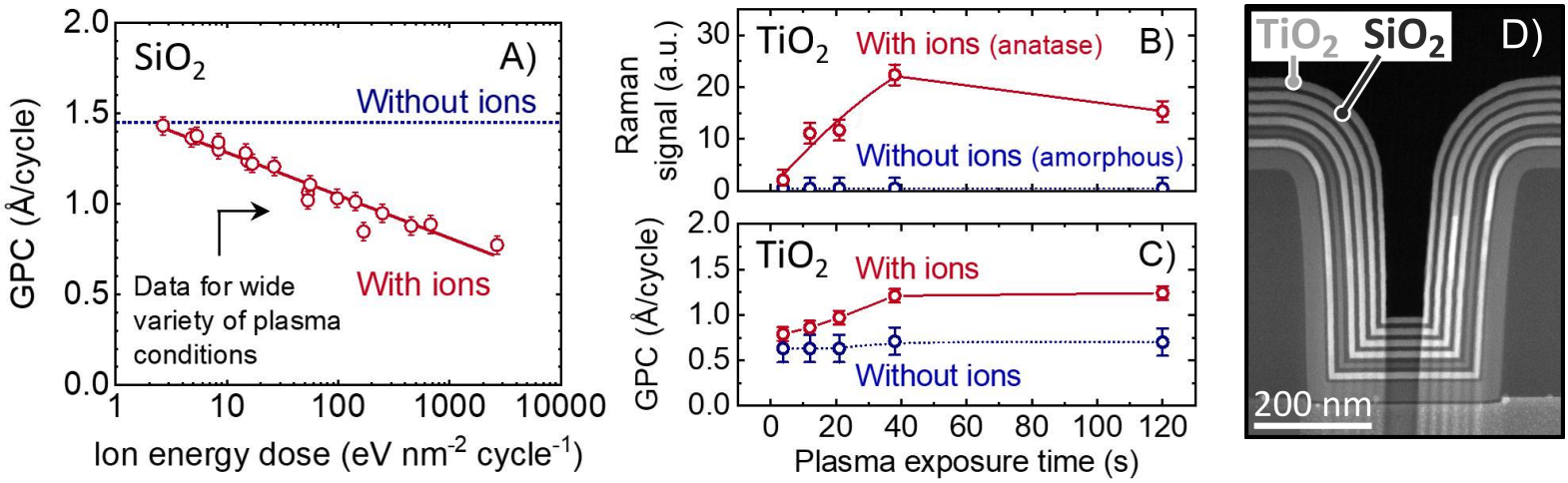


Figure S2: Growth per cycle (GPC) of SiO_2 (A) and TiO_2 films (C) grown by plasma ALD at 200 °C, with and without exposure to ions. For SiO_2, the GPC decreases upon exposure to ions, where the magnitude of the effect can be controlled by the ion energy dose. In contrast, for TiO_2 the GPC increases upon exposure to ions. This is related to ion-induced crystallization, as indicated by the Raman spectroscopy signal intensity corresponding to the anatase phase of TiO_2 (B). For both materials, ions are demonstrated to have a beneficial effect on the material quality, yet significantly influence the film conformality obtained on 3D nanostructures (D).